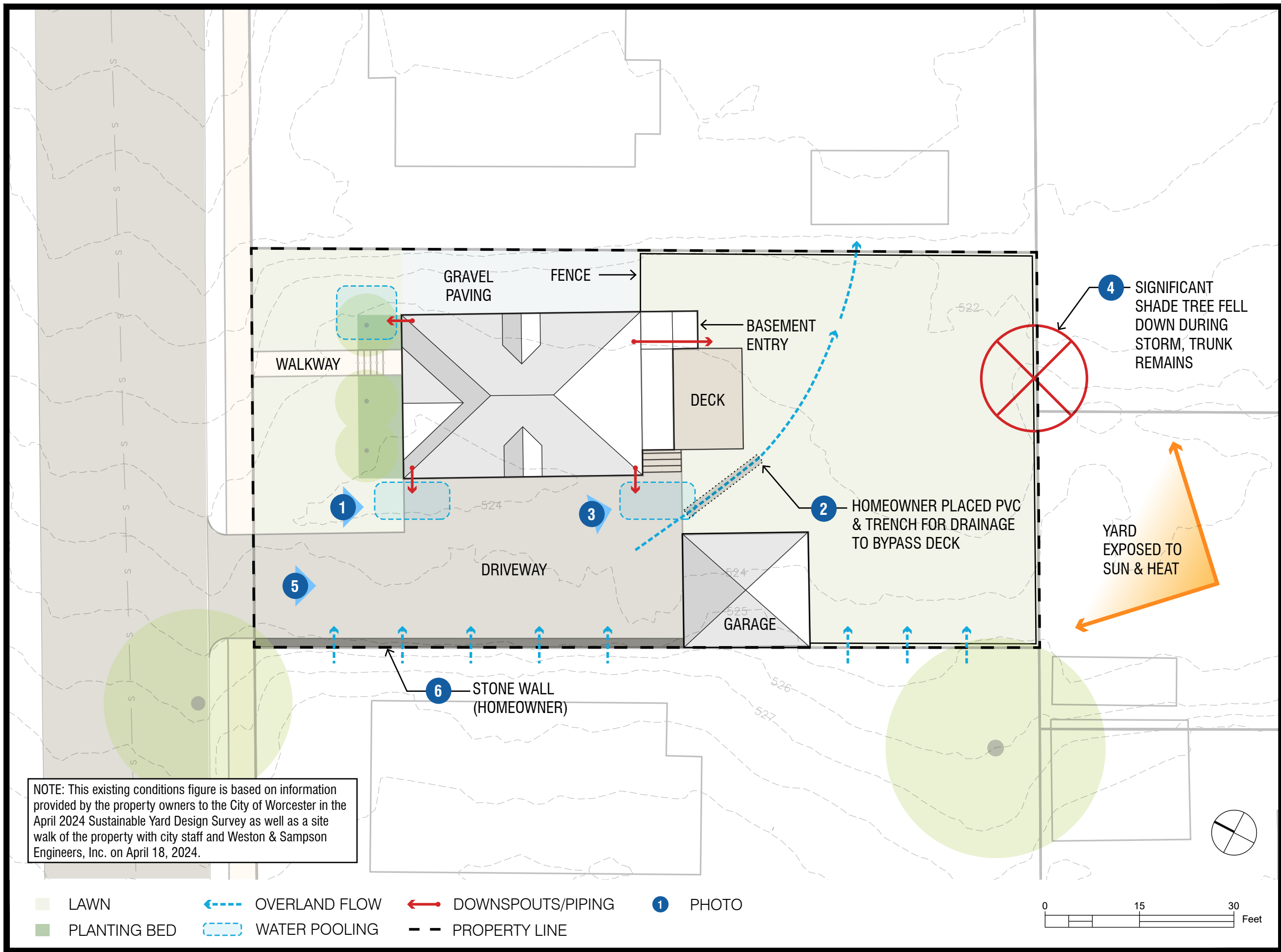


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Project:
SUSTAINABLE YARD DESIGN
CASE STUDY 2
WORCESTER, MA

Weston & SampsonSM

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Date: 05/09/24
Drawn By: CD
Reviewed By: AS
Approved By: JM

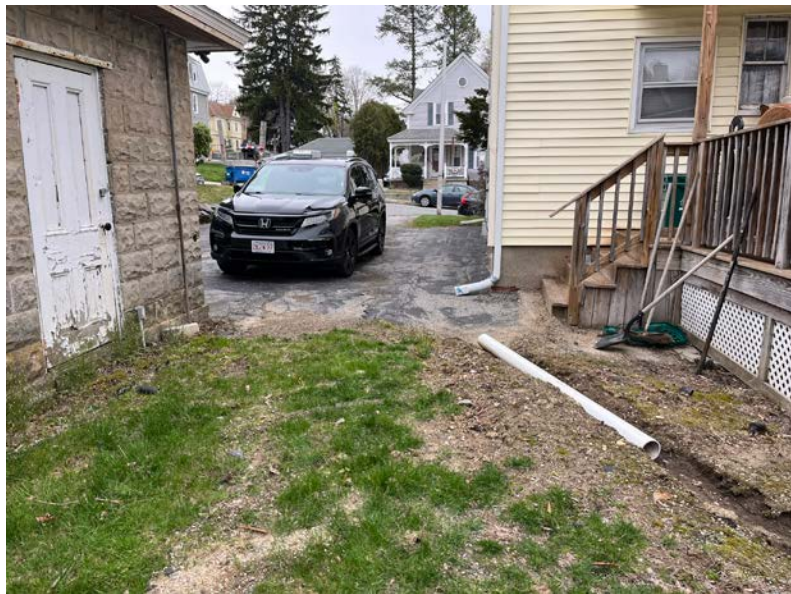
W&S Project No.: ENG22 - 1048
W&S File No.:

Drawing Title:
EXISTING CONDITIONS
PLAN

Sheet Number:
C101



1 WATER POOLING AT DRIVEWAY



2 HOMEOWNER PLACED PVC & TRENCH FOR DRAINAGE TO BYPASS DECK



3 EROSION AND WATER DAMAGE AT BASE OF DECK



4 SIGNIFICANT SHADE TREE FELL DOWN DURING STORM, TRUNK REMAINS



5 SIGNS OF WATER POOLING IN ASPHALT DRIVEWAY



6 WATER RUNOFF FROM NEIGHBORING PROPERTY ALONG STEEP SLOPE

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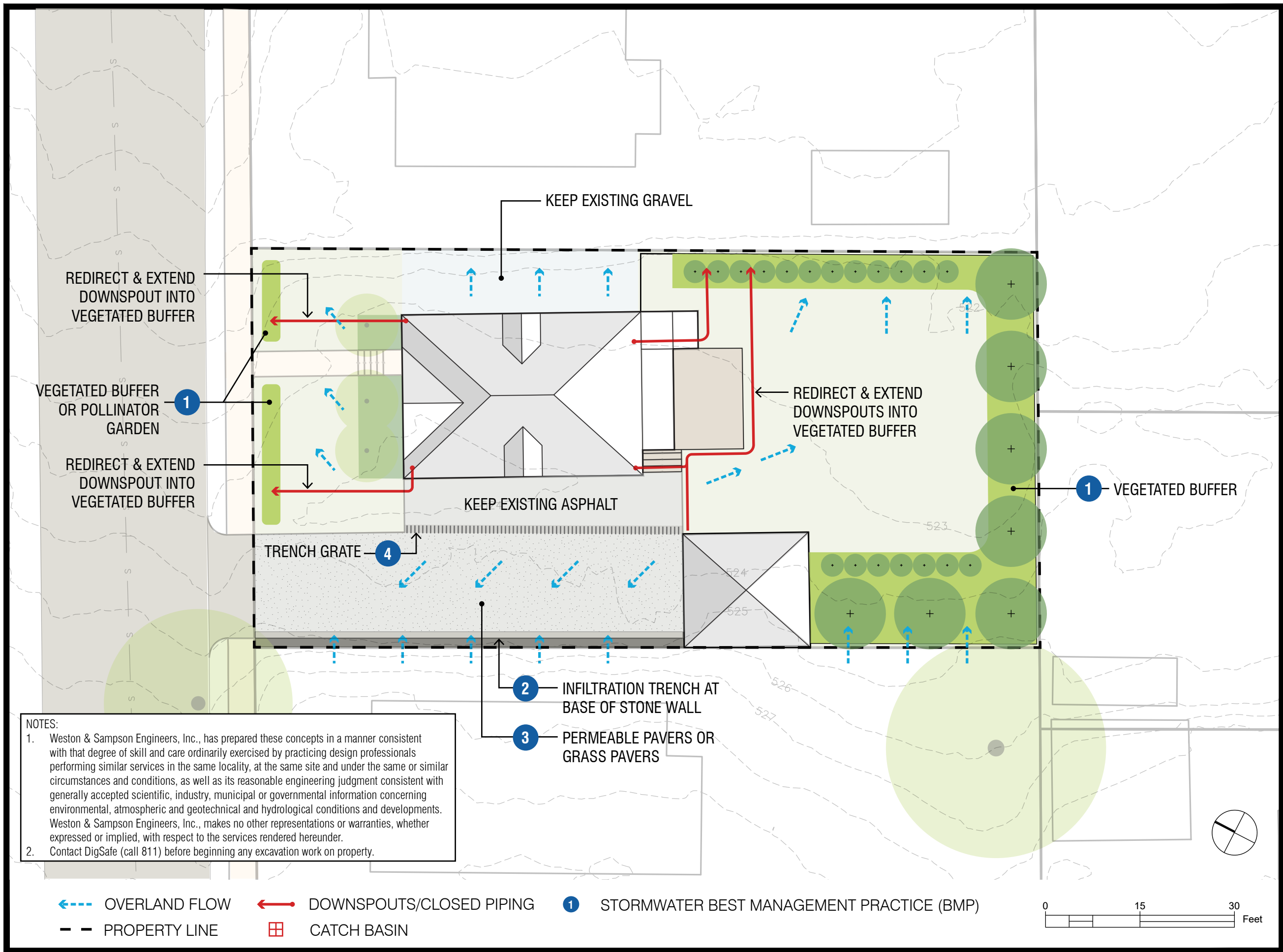
Scale:
Date: 05/09/24
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W&S Project No.: ENG22 - 1048
W&S File No.:

Drawing Title:
EXISTING CONDITIONS
PHOTOS

Sheet Number:
C102

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W&S Project No.: ENG22 - 1048
W&S File No.:

Drawing Title:

SITE PLAN

Sheet Number:

C201

STORMWATER BEST MANAGEMENT PRACTICE (BMP)



1 VEGETATED BUFFER



2 INFILTRATION TRENCH



3 PERMEABLE PAVERS



4 TRENCH GRATE

NOTE: Plant suitability is not limited to the sample plant list. A professional horticulturalist, landscape designer, or landscape architect can help in exploring additional species suitable for your site.

CONSIDERATIONS FOR PLANTING

Refer to the UMASS Extension Landscape, Nursery and Urban Forestry Program “[Plant Selection for Managed Landscapes: Right plant, right place](#)” guidelines below when selecting landscape plants.

- Some site conditions to keep in mind when selecting landscape plants include:
- light availability, intensity and duration (full sun to deep shade)
 - water availability, both quantity and quality
 - exposure to wind and temperature extremes
 - soil type, drainage, compaction
 - hardiness zone
 - competition from existing vegetation
 - below ground conditions in urban sites
 - above ground wires or obstructions

- Aesthetic considerations for plant selection include:
- growth habit, i.e. pyramidal, columnar, spreading, etc.
 - season and color of bloom
 - foliage color, texture, and shape
 - winter interest of bark, fruit, or structure
 - benefits to wildlife
 - fall color
 - longevity

PLANT SELECTION BY FUNCTION

- [Pollinator Garden](#) (massnrc.org/ppd/)
- [Rain Garden](#) (mass.gov/info-details/stormwater-solutions-for-homeowners)
- [Understory Planting for Erosion Control](#) (mass.gov/info-details/stormwater-solutions-for-homeowners)
- [Vegetated Buffer](#) (mass.gov/info-details/stormwater-solutions-for-homeowners)
- [Vegetated Swale](#) (mass.gov/info-details/stormwater-solutions-for-homeowners)

WHERE TO PURCHASE NATIVE PLANTS

- [Grow Native Massachusetts](#) (grownativemass.org/Great-Resources/nurseries-seed)
- [Native Plant Trust](#) (nativeplanttrust.org)
- [Native Plant Initiative](#) (apcc.org/our-work/education/native-plant-initiative/)
- [Blue Stem Natives](#) (bluestemnatives.com)
- [New England Wetland Plants](#) (newp.com)
- [Tree Talk Natives](#) (treetalknatives.com)
- [American Beauties Native Plants](#) (abnativeplants.com)
- Lady Bird Johnson Wildflower Center (wildflower.org)
- [National Nursery and Seed Directory](#) (nnp.rngr.net/resources/directory)
- [Arbor Day Foundation](#) (arborday.org)

SAMPLE PLANT LIST

VEGETATED BUFFER

- Grasses & Perennials
- Ostrich Fern (*Matteuccia struthiopteris*)
 - Royal Fern (*Osmunda regalis*)
 - New England Aster (*Symphotrichum novae-angliae*)
 - Green-Headed Coneflower (*Rudbeckia laciniata*)
- Shrubs & Trees
- Sweet Pepperbush (*Clethra alnifolia*)
 - Serviceberry (*Amelanchier canadensis*)
 - Flowering Dogwood (*Cornus florida*)
 - Kousa Dogwood (*Cornus kousa*) *Non-native dogwood, less susceptibility to dogwood anthracnose

POLLINATOR GARDEN

- Perennials
- Star Flower (*Amsonia tabernaemontana*)
 - Marsh Marigold (*Caltha palustris*)
 - Red Columbine (*Aquilegia canadensis*)
 - Blue Iris (*Iris versicolor*)
 - Blue Wild Indigo (*Baptisia australis*)
 - Joe-Pye Weed (*Eupatorium maculatum*)
 - Swamp Milkweed (*Asclepias incarnata*)
 - Coneflower (*Echinacea purpurea*)
 - Foxglove (*Penstemon digitalis*)
 - Smooth Aster (*Aster laevis*)
 - Bolton’s Aster (*Boltonia asteroides*)
 - False Sunflower (*Heliopsis helianthoides*)

NATURE-BASED SOLUTIONS RESOURCES

- [Easthampton Homeowner’s Guide to Do-it-Yourself Stormwater Management Solutions that Improve Community Resilience](#) (easthamptonma.gov/DocumentCenter/View/3891/Residential-Guide-to-Stormwater-Management---English?bidld=)
- [National Fish and Wildlife](#) (www.stormwaterguide.org/static/HomeownersGuide.pdf)

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Drawing Title:

SITE PLAN

Sheet Number:

C202



Prepared by Weston & Sampson, May 2024

Item Description	Quantity	Unit	Unit Price	Total Price	Notes	Reference Link
Downspout Extensions						
Aluminum Downspout	11	10 FT	\$16.50	\$181.50	Downspout piping typically sold in 10-ft segments. ~\$16.50 for 2"x3"x10' segment, per Home Depot. Larger size (3"x4"x10') is ~\$18.	https://www.homedepot.com/p/Amerimax-Home-Products-2-in-x-3-in-x-10-ft-White-Aluminum-Downspout-2601000120/100016183
Aluminum Downspout B-Elbow	5	EA	\$4.25	\$21.25	B-Elbows allow for horizontal turns on the ground. 2"x3" ~\$4.25, 3"x4" ~\$5.25, per Home Depot.	https://www.homedepot.com/p/Amerimax-Home-Products-2-in-x-3-in-White-Aluminum-Downspout-B-Elbow-27065/100011647
River Stone Apron at Downspout Outlet	10	CF	\$10.00	\$100.00	Assume 10 sf x 3" deep per apron. 4 aprons needed. Per home depot, one 0.5-cf bag costs ~\$5. Alternatively could use the same crushed stone as the infiltration trench.	https://www.homedepot.com/p/Vigoro-0-5-cu-ft-Bagged-River-Pebble-Landscape-Rock-54250V/100558618
Contingency	20%	Subtotal		\$302.75		
				\$60.55		
		Total		\$363.30		
Hardscape Driveway Improvements						
Crushed Stone for Infiltration Trench	50	CF	\$28.00	\$1,400.00	Assume 1' x 68' x 8" trench. 25 cf pallet of 3/8" crushed stone/gravel is ~\$700, per home depot. Assume 2 pallets are needed. Assume existing pavement would be removed during driveway upgrades.	https://www.homedepot.com/p/Southwest-Boulder-Stone-25-cu-ft-3-8-in-Crushed-Gravel-Bulk-Landscape-Rock-and-Pebble-for-Gardening-Landscaping-Driveways-and-Walkways-02-0095/312642186
Geotextile Fabric Liner for Infiltration Trench	170	SF	\$0.10	\$17.00	Assume ~68 sf trench footprint, plus an additional 1.5 ft along the entire 68-ft length to cover both sides. Assume \$0.10 per sf based on multiple Home Depot Options.	
Permeable/grass Paver Installation *	1	LS	\$30,000.00	\$30,000.00	Includes materials & labor. Lump sum cost estimated from reference residential project completed in June 2014, scaled to this project for driveway area and adjusted dollar value. Reference project was 2-car driveway length, assume this project is 3-car length. Assume \$1 in 2014 = \$1.32 in 2024, per US Inflation Calculator.	https://www.usinflationcalculator.com/
Trench Drain/Grate	5	3-PK (9.8 FT)	\$65.00	\$325.00	Typically available in 39.4" segments. 3-pack of compact series channel & grate is ~\$65, 3-pack of deep series is ~\$80 (both U.S. Trench Drain), per Home Depot. HDPE grates can withstand loading for typical residential driveways.	U.S. Trench Drain compact 3-pack: https://www.homedepot.com/p/U-S-TRENCH-DRAIN-Compact-Series-5-4-in-W-x-3-2-in-D-x-39-4-in-L-Trench-and-Channel-Drain-Kit-with-Black-Grate-3-Pack-9-8-ft-83500-3/302782641 U.S. Trench Drain deep 3-pack: https://www.homedepot.com/p/U-S-TRENCH-DRAIN-Deep-Series-5-4-in-W-x-5-4-in-D-x-39-4-in-L-Trench-and-Channel-Drain-Kit-with-Black-Grate-3-Pack-9-8-ft-83300-3/302782501
Contingency	20%	Subtotal		\$31,742.00		
				\$6,348.40		
		Total		\$38,090.40		
Backyard Plantings						
Mulch - 3"	290	CF	\$2.00	\$580.00	~1150 sf backyard planting area	https://www.homedepot.com/p/Vigoro-2-cu-ft-Bagged-Premium-Black-Wood-Mulch-52050197/205606445
Bioretention Soil Mix - 18"	64	CY	\$30.00	\$1,920.00	~1150 sf backyard planting area	Other projects
Coarse Sand - 1"	4	CY	\$55.00	\$220.00	~1150 sf backyard planting area	Other projects
Tree Plantings	7	EA	\$350.00	\$2,450.00	Assume 2-2.5" caliper.	
Shrub Plantings	19	EA	\$12.00	\$228.00	1 gal buckets ~\$12 per NEWP, other plant size options available, see links to right	NEWP: https://newp.com/catalog/shrubs/ NPT: https://newfs-society.s3.amazonaws.com/documents/2024-05-02_NPT_2024_Plants_Price_Availability_List.pdf
Erosion Control/Restoration Mix for Moist Sites	3	LBS	\$39.00	\$117.00	1250 sf per lb, minimum order 3 lbs. Planting area in backyard ~1150 sf.	https://newp.com/product/new-england-erosion-control-restoration-mix-for-detention-basins-and-moist-sites/
Contingency	20%	Subtotal		\$5,515.00		
				\$1,103.00		
		Total		\$6,618.00		



Prepared by Weston & Sampson, May 2024

Item Description	Quantity	Unit	Unit Price	Total Price	Notes	Reference Link
Front Yard Plantings						
Mulch - 3"	25	CF	\$2.00	\$50.00	~100 sf front yard planting area	https://www.homedepot.com/p/Vigoro-2-cu-ft-Bagged-Premium-Black-Wood-Mulch-52050197/205606445
Bioretention Soil Mix - 18"	6	CY	\$30.00	\$180.00	~100 sf front yard planting area	Other projects
Coarse Sand - 1"	1	CY	\$55.00	\$55.00	~100 sf front yard planting area	Other projects
Erosion Control/Restoration Mix for Moist Sites	3	LBS	\$39.00	\$117.00	1250 sf per lb, minimum order 3 lbs. Planting areas in front yard ~100 sf.	https://newp.com/product/new-england-erosion-control-restoration-mix-for-detention-basins-and-moist-sites/
			Subtotal	\$402.00		
Contingency				\$80.40		
			Total	\$482.40		
TOTAL COST				\$45,554.10		

Notes:

* Labor costs are included in this price.

1. Costs are for materials only and exclude labor costs (contractor). Except for item with *

2. Costs are presented in 2024 US dollars and include a 20% contingency.

3. Costs are based on pricing from Home Depot, New England Wetland Plants, Inc., Native Plant Trust, and reference pricing from other projects

4. Weston & Sampson Engineers, Inc. makes cost estimates using its best judgement as an experienced and qualified professional engineer generally familiar with the construction industry. Weston & Sampson Engineers, Inc. has no control over the cost of labor, materials, equipment or services furnished by others, or any methods of determining prices, or competitive bidding or market conditions when the project will be constructed. Weston & Sampson Engineers, Inc. cannot and does not guarantee that a contractor’s bids or actual construction costs will not vary from cost estimates prepared. If property owner desires greater assurance as to probable construction cost, property owner should obtain a quote from a contractor.